FURNITURESYSTEMCOMPOSED OF PANEL-SHAPED ELEMENTS

The present invention relates to a furniture system which is composed of at least first and second rectangular panel-shaped elements, in each case with a first and a second panel-shaped element positioned at an angle with respect to one another and each panel-shaped element comprising two bearing surfaces and end sides which connect the bearing surfaces, the panel-shaped elements being assembled to form a furniture system using connecting elements.

A furniture system of this type is known from DE-A 28 48 523.

The said document describes a furniture system of the type described in the introduction in which rectangular panel-shaped elements are connected to one another by dowels which are fixed into the end sides of the panel-shaped elements and passed through openings in coupling parts which are used. The dowels are fixed in place, for example, by adhesive bonding.

A furniture system of this type is time-consuming to erect; if the adhesive bonding of two adjacent dowels comes loose, the furniture system may fall apart, with all the associated risks.
It is an object of the present application to provide a solution to the above problems, and to this end the invention is characterized in that the connecting elements are tie rods, at least part of which runs parallel to the panel-shaped elements, the tie rods connecting the panel-shaped elements under tension.

As a result of the connecting elements being formed by tie rods which run partly parallel to the panel-shaped elements, the panel-shaped elements are connected to one another under tension, whether directly or indirectly, providing safety and allowing extraordinarily simple assembly of a furniture system, as will be explained in more detail below.

The embodiments with direct and indirect connection of the panel-shaped elements will be discussed in detail below.

The preamble given above refers to panel-shaped elements which form an angle with one another. For a furniture system, the angle will expediently be 90°; however, the description is also intended to encompass other arrangements, such as for example panel-shaped elements which form an angle of 60° with respect to one another or indeed any other suitable angle.

In a first attractive embodiment, the panel-shaped elements are indirectly connected to one another in such a manner that a panel-shaped element in each case bears by means of one end side against a coupling part with a quadrilateral cross section, and the tie rods ensure that the end side in question and the coupling part bear against one another, the coupling part having protuberances at the corners, which bear against the two bearing surfaces of the corresponding panel-shaped element. The indirect connection between the panel-shaped elements is therefore effected via a coupling part which is quadrilateral in cross section, with protuberances on the coupling part ensuring that the panel-shaped element cannot sag with respect to the coupling part.

A quadrilateral cross section, such as a rectangle, makes it possible to use panel-shaped elements of different thicknesses, with one end side of a certain thickness bearing against the side of a coupling part of the same thickness.

A coupling part may be formed from metal, plastic, wood or any other solid or hollow material.

A major advantage in the furniture system according to the present invention is that the same coupling part can be used throughout the entire furniture system, with the same shape and design in all cases.

Obviously, the coupling parts can also be used for securing

means in order to enable things to be suspended or guided in the furniture, such as hooks, rods, rails, etc.

The tie rods are mounted in such a manner that, as indicated above, the panel-shaped elements bear under tension against in this case a coupling part. As will be explained in more detail below, the tie rods have to be positioned at a fixed point at least at the ends, in order to enable tension to be applied. For example, a tie rod may extend over the entire width or height of a furniture system and may be fixed to the outer side of the furniture system with the aid of, for example, a cap nut.

Otherwise, as will also be discussed below, a tie rod may also be composed of partial tie rods, in which case they are fixed either to the outer side of the furniture system or the partial tie rods are fixed in a coupling part.

Advantageously, the coupling part and the end side of the panel-shaped element which bears against it are of the same length and the tie rods run inside cavities which are left clear inside the corresponding panel-shaped element. In this embodiment, the tie rods, with the possible exception of the ends, are completely hidden away inside the panel-shaped elements of the furniture system.

In another embodiment, the coupling part is of a greater length than the end side of the panel-shaped element which bears against it, and the tie rods run outside the corresponding panel-shaped element. The system of tie rods is then visible at the front and the rear of the furniture system, which may have an exceptional decorative effect.

In the case outlined above in which the tie rods are located outside the panel-shaped elements, the cavities in the panel-shaped elements for the tie rods to pass through can of course be dispensed with.

In this case, the panel-shaped elements may also be of solid

design, for example made from plastic, wood or, if desired, metal. In all cases, the tie rods will lead through openings in the coupling parts and, working on the basis of rectangular panel-shaped elements and coupling parts with a quadrilateral cross section, the tie rods will, when the furniture system is in use, extend in the vertical and horizontal directions. Working on the basis of one single coupling part, there are openings which allow tie rods or tie-rod parts to pass through in the horizontal direction and openings which allow tie rods on the tie-rod parts to pass through in the vertical direction. These openings, for the tie rods or tie-rod parts to pass through in the vertical and horizontal directions, are advantageously located at both ends of a coupling part, i.e. an opening for the tie-rods or tie-rod parts to pass through in the vertical direction and an opening for tie rods or tie-rod parts to pass through in the horizontal direction at one end. A plane which is positioned vertically on the coupling part and which includes a tie rod or tie-rod part which has passed through the coupling part horizontally is located at a short distance from a plane which includes a tie-rod or tie-rod part which has passed through in the vertical direction. The distance between such planes is not critical; by way of example, a distance of 30 mm may be suitable, but other distances can also be used.

In a first advantageous embodiment, the furniture system is characterized in that at least two tie rods interact with each of the first and second panel-shaped elements, in that the coupling element is square in cross section, and in that the coupling part includes openings into which a coupling nut fits, inside which coupling nut there is a hole with an internal screw thread, and a tie rod which is present in the furniture system is composed of a plurality of partial tie rods having, at least at both ends, an external screw thread, these partial tie rods being connected to one another by coupling nuts and each partial tie rod being of a length of at most the dimension of the panel-shaped element to which it is parallel plus the length of the side of the coupling part, and a cap nut which bears against an end coupling part on the outside of the furniture system being

present at both ends of the tie rod thus constructed, and the coupling part being suitable for coupling partial tie rods running in at least two mutually perpendicular directions of the furniture system with the aid of coupling nuts.

In this embodiment, a tie rod is composed of a number of partial tie rods which are coupled to one another by coupling nuts, the coupling nut being accommodated inside an opening in a coupling part which is square in cross section. The tie rods composed of the partial tie rods extend over virtually the entire dimension of the furniture system in the horizontal and vertical directions, and the ends are fixed to the outer side of an outermost coupling part with the aid of cap nuts. The coupling nut is expediently cylindrical and fits closely, with little play, into openings in the coupling parts. A coupling nut with an external shape which differs from that of a cylinder is also possible if it is ensured that the openings in the coupling part are of a corresponding shape. The tension with which the panel-shaped elements bear against a coupling part is defined by the extent to which the cap nuts are tightened at the ends of the tie rod composed of the partial tie rods.

In another attractive embodiment, the furniture system is characterized in that at least two tie rods interact with each of the first and second panel-shaped elements, in that the coupling part is square in cross section and the coupling part includes openings into which a spacer sleeve fits, in which spacer sleeve there is a hole with an internal diameter which allows the external diameter of a tie rod which forms part of the furniture system to pass through it in a tightly fitting manner, and at both ends of the tie rod there is a screw thread on which there is a cap nut which bears against an end coupling part on the outside of the furniture system, and the coupling part is suitable for tie rods running in at least two mutually perpendicular directions of the furniture system to pass through via spacer sleeves. In this embodiment, tie rods run over the entire width and height of the furniture system; the ends are once again fixed to coupling parts which bear against the outer

side of the furniture system with the aid of cap nuts, so that once again the tension in the tie rod can be adjusted. The tie rods run through openings in the respective coupling parts; a spacer sleeve in which there is a hole which allows the tie rod to pass through it in a tightly fitted manner fits into each opening.

The spacer sleeves are important for the purpose of protecting material of the coupling parts.

A protective function of this nature is particularly advantageous for coupling parts made from plastic.

If the coupling part consists, for example, of metal, spacer sleeves can be dispensed with if desired. In this case, the tie rods are guided in a tightly fitting manner through openings in the coupling parts.

In a highly attractive further embodiment, the furniture system according to the invention is characterized in that at least two tie rods interact with each of the first and second panel-shaped elements, in that the coupling part is square in cross section and the coupling part includes openings, into which a rotationally symmetrical coupling nut fits, in which coupling nut there is a hole with an internal screw thread, and a tie rod which forms part of the furniture system is composed of a plurality of partial tie rods having, at least at both ends, an external screw thread, the said partial tie rods being connected to one another by coupling nuts, each partial tie rod being of a length of at most the dimension of the panel-shaped element to which it is parallel plus the length of the side of the coupling part, a coupling nut having, over its length, two regions with different external cross-sectional surfaces, the openings in the coupling part being formed so as to be complementary with the coupling nut, and the coupling nut being provided with means for rotating it with respect to a partial tie rod, while the coupling part is suitable for coupling partial tie rods running in a least two mutually perpendicular directions of the

furniture system with the aid of coupling nuts.

In this case too, the tie rods are composed of partial tie rods, the coupling nuts being formed in such a way that they fit and locate a supporting point for tightening inside openings in the coupling parts which are formed to be complementary with respect to the shape of the coupling nuts. One example is the following: A part of a furniture system which is composed of two panel-shaped elements comprises, in its plane, three coupling parts, namely two on the outer side and one between the panel-shaped elements. A tie rod composed of partial tie rods comprises a coupling nut in the two outermost coupling parts and a coupling nut in the coupling part between the two panel-shaped elements. The coupling nuts which are arranged at the ends of the tie rod which has been formed in two parts are mounted in mirror-image fashion with respect to one another, in such a manner that the widened external cross-sectional area of the coupling nuts is located on the outer side of the two outermost coupling parts, i.e. tightening one or both outer coupling nuts holds the tie rod under tension onto the middle coupling part.

In this embodiment, the coupling nuts can be turned with respect to a partial tie rod in order to allow tightening. It is expedient for the means for turning a coupling nut with respect to a partial tie rod to be formed by a hexagon socket part in the hole in the coupling nut which replaces the internal screw thread over part of the length.

The attractive aspect of this embodiment, in which the tie rods are composed of partial tie rods and the coupling nuts can tighten the partial tie rods with respect to the coupling parts, is that the furniture system can be of modular structure. Working on the basis of a furniture system in a form selected by the owner, it is easy to extend or reduce the system using simple means.

The coupling nuts are expediently tightened in such a manner that the sum of the tensile stresses of the partial tie rods

corresponds to the tensile stress which is desired for the complete tie rod in question.

Up to this point, the application has spoken of a furniture system in which the panel-shaped elements bear against one another under tension indirectly, i.e. via a coupling element.

However, the furniture system according to the invention, in which the connecting elements are formed by tie rods, may also be formed without the addition of coupling parts, and in an advantageous embodiment a furniture system of this type is characterized in that it comprises a desired number of first panel-shaped elements and at least two second panel-shaped elements, and in that in a direct connection a first panel-shaped element in each case bears by means of an end side against a bearing surface of a second panel-shaped element, a first panel-shaped element and a second panel-shaped element are perpendicular to one another, there are at least two tie rods per first panel-shaped element, the tie rods are longer than the distance between those bearing surfaces of the second panel-shaped elements or the outermost second panel-shaped elements which face away from the furniture system, and the tie rods lead through openings in the second panel-shaped elements and project outside the latter, the ends of the tie rods are provided with a screw thread, and a cap nut is present at both ends of a tie rod, bearing against the corresponding bearing surface of a second panel-shaped element, so that a desired tensile stress can be applied to each tie rod by tightening the cap nut or cap nuts. The panel-shaped elements are positioned perpendicular to one another, and in general an end side of one panel-shaped element will bear under tension against the bearing surface of another panel-shaped element. An example which may be given is a furniture system which comprises first and second panel-shaped elements, with the first panel-shaped elements in each case being received between two second panel-shaped elements, in which case the second panel-shaped elements are, for example, positioned vertically. The tie rods extend over the entire width of a furniture system formed in this way and are fixed, with the

aid of cap nuts, against the outer side of the second panel-shaped elements, with the desired tensile stress being applied by tightening the cap nuts on the tie rods.

Obviously, it is also possible for furniture systems of this type to be constructed with more than two second panel-shaped elements; in this case, the tie rods will also extend over the entire width of the furniture system, assuming that the second panel-shaped elements are positioned vertically when the furniture system is in use.

The invention also relates to a panel-shaped element for use in a furniture system in accordance with the invention described above, comprising two bearing surfaces and end sides connecting the bearing surfaces, which is characterized in that the panel-shaped element comprises at least two elongate, parallel cavities which are arranged between the bearing surfaces and each allow a tie rod to pass through, each cavity running parallel to an end side.

In an attractive embodiment, the panel-shaped element described above is characterized in that it comprises at least one opening, the axis of which is perpendicular to the bearing surfaces and which intersects the axis of the cavity for a tie rod to pass through, which opening is suitable for receiving a securing sleeve which, within its length, comprises an opening for a positioned tie rod to pass through, the securing sleeve comprising, at at least one end, a threaded opening for securing a desired component, such as handles and locks, hinges, rails or the like, to a bearing surface of the panel-shaped element. This embodiment therefore allows the furniture system to be provided with additional components, such as doors, rails for, for example, boards or drawers which slide out, rods for clothes to be hung from and the like.

The axis of the opening for receiving a securing sleeve, as described above, is expediently positioned perpendicular to the bearing surfaces of a panel-shaped element; if desired, however, the axis of an opening may also extend parallel to the bearing surfaces, so that an opening for receiving a securing sleeve

ends at an end side of a panel-shaped element.

A panel-shaped element for use in a furniture system according to the invention preferably comprises four cavities which are parallel to one another and are positioned in pairs in the vicinity of two parallel end sides, while a plurality of openings for receiving in each case one securing sleeve are present over the length of each cavity. The openings are positioned in such a manner that the desired components as referred to above can be received without problems.

With regard to a panel-shaped element which is provided with one or more openings for receiving a securing sleeve, it should be noted that the openings may be selected from openings which extend over the entire distance between the bearing surfaces and openings which extend over a distance which is less than the distance between the bearing surfaces.

In the case of openings which extend over the entire distance between the bearing surfaces, it may be the case that the securing sleeve which is to be received therein is of substantially the same length as the distance between the bearing surfaces of the corresponding panel-shaped elements; of course, it is also possible to use a securing sleeve of a greater length. In the latter case, the projecting section of the securing sleeve can be used not only to fix in place desired components but also as a support point for separate shelves which are to be used. A shelf of this type may be in the form of a panel-shaped element as used in the furniture system; it is also possible to use any other panel-shaped body made from plastic, wood, metal or glass.

The securing sleeve which is to be used may also be of a length which is shorter than the distance between the bearing surfaces of a panel-shaped element. In this case, the opening in the panel-shaped element also extends over a length which is shorter than the distance between the bearing surfaces, and the opening is then only visible on one side of the panel-shaped element. Panel-shaped elements with this type of "blind" openings are used as the outer boundary of a furniture system. The components

which are to be secured are then secured exclusively in the interior of the furniture system.

The panel-shaped elements which can be used in the furniture system described above may be of numerous designs; advantageously, the panel-shaped element is produced by injection-moulding or extrusion of thermoplastic, and the cavities are surrounded by ribs which run between the bearing surfaces of a panel-shaped element, and furthermore additional ribs are present. Various types of plastic can be used; polyvinyl chloride and polypropylene may be mentioned in this context.

Finally, the invention relates to a securing sleeve for use with a panel-shaped element as described above, wherein he securing sleeve is in the shape of an elongate cylinder with a hole at at least one end and a screw thread incorporated in this hole, and an opening, the axis of which is perpendicular to the axis of the securing sleeve and which is suitable for a threaded rod to pass through.

The invention will now be explained with reference to a drawing, in which:

Fig. 1 diagrammatically depicts a furniture system according to the invention;

Fig. 2 shows a panel-shaped element for use in the furniture system;

Fig. 3 shows a diagrammatic combination of a way of connecting panel-shaped elements via coupling parts when using tie rods consisting of one part;

Fig. 4 shows an arrangement corresponding to that shown in Fig. 3 but with the tie rods being assembled from partial tie rods using asymmetric coupling nuts;

Fig. 5, 5a show a detailed view of the function of the coupling nuts for connecting the partial tie rods shown in Fig. 4;

Fig. 6 shows a cross section through a coupling part with protuberances at the corners;

Fig. 7 shows a tie rod which passes through openings in two

coupling parts but not through openings in a panel-shaped element;

Fig. 8 shows a sketch of a panel-shaped element with an end side which is provided with a recess through which a tie rod or tie-rod part can run;

Fig. 9 shows a cylindrical coupling nut with a hole provided with an internal screw thread;

Fig. 10 shows a cylindrical spacer sleeve in which there is a cylindrical hole;

Fig. 11 shows a furniture system which is constructed without the use of coupling parts and in which the panel-shaped elements bear directly against one another;

Fig. 12, 12a show a detailed view of a panel-shaped element in which there are cavities for tie rods to pass through;

Fig. 13 shows an arrangement in which a securing sleeve interacts with a threaded rod running through a panel-shaped element;

Fig. 14 shows a securing sleeve for use in the arrangement presented in Fig. 13.

In Fig. 1, a furniture system is denoted by reference number 1; 2 and 3 are panel-shaped elements which in this case run horizontally and vertically, respectively, when the furniture system is in use. The panel-shaped element 2 and 3 are connected to one another via coupling parts 4 using tie rods which in this case run inside cavities in the panel-shaped elements. 7 and 8 respectively denote ends of horizontal and vertical tie rods; 9 denotes openings in a coupling part 4 which are in this case unused.

The coupling nuts indicated at 7 and 8 are in this case cap nuts which can be used to tighten the corresponding tie rods in the horizontal and vertical direction.

On account of its structure, the furniture system according to the invention is particularly stable and retains its shape even under load. There is therefore no need to fit a stabilizing back

wall or diagonal strut, unless this is desired for aesthetic or other reasons.

Fig. 2 shows a panel-shaped element, which in this case may be formed from polyvinyl chloride or polypropylene by extrusion. The panel comprises cavities 5 and reduced cavities 6 for tie rods to pass through; the shape and structure of the latter cavities 6 will be discussed in more detail below.

Fig. 3 shows a way of connecting two horizontally positioned panel-shaped elements 12 and one vertically oriented panel-shaped element 13 via coupling parts 14. It can be seen from this figure that there are tie rods 15 and 16 which extend through the coupling parts and the panel-shaped elements 12 and 13. In this case, the openings in the coupling parts 14 allow the tie rods 15 and 16 to pass through in a tightly fitting manner; it is also possible for spacer sleeves to be present in the openings in the coupling parts 14 and 15, as discussed above. The latter variant is important in particular if the coupling parts consist of thin-walled plastics. The spacer sleeves then prevent damage to the plastic walls. The tie rods are placed under tension by cap nuts which bear against coupling parts 14 which are located at the outer periphery of the furniture system which is to be formed. As a result of the nuts being tightened, the tie rods are placed under a desired tension. The coupling parts 14 are, as is customary, equipped with protuberances which bear against the bearing surfaces of the panel-shaped elements 12 and 13, so that these panel-shaped elements are prevented from sagging and a pleasing finish of the joins between coupling parts and panel-shaped elements is obtained. For each panel-shaped element there are at least two tie rods, although it is also possible to use more tie rods. At least at their ends, the tie rods have a threaded section, so that a cap nut can be screwed on; it is of course possible for the tie rods to be threaded over their entire length.

The tie rods may be made from any type of material which is able to absorb tensile stress, such as steel, for example galvanized

steel, or plastic, for example nylon.

A tie rod made from galvanized steel has a diameter of, for example, 5 mm, although larger or smaller diameters are possible.

Of course, a coupling part may be of any desired size; in the case of a tie rod with a diameter of 5 mm, a square coupling part with a side length of 20 mm is highly suitable.

In this case, the panel-shaped elements have a thickness of approximately 20 mm, so that their end sides fit between the protuberances on the coupling parts.

Fig. 4 shows the situation from Fig. 3, but with the tie rods assembled from partial tie rods 15' and 16'. Coupling nuts 17 are present for coupling the partial tie rods 15', 16' to one another within the connecting parts 14; the coupling nuts 17 have two different external cross sections over their cylinder length, the openings in the coupling parts 14 having a cross-sectional shape which is complementary with respect to the external cross-sectional shape of the coupling nuts 17. For assembly, by way of example, partial tie rods 15' are passed through the cavities in a panel-shaped element 12, in such a manner that the threaded ends of these partial tie rods project outside the panel-shaped element. A coupling part 14 is fitted over the threaded ends and coupling nuts 17 are screwed onto the threaded ends, in such a manner that the coupling nut comes to lie inside the coupling part 14 and, if the other end of the partial tie rod is pulled, the coupling nut pulls the coupling part 14 onto the panel-shaped element 12. Then, a new coupling nut is screwed onto the other end of the partial tie rod, which projects outside the panel-shaped element 12, in the manner indicated in Fig. 4. A new coupling part 14 is in turn pushed over these coupling nuts; the coupling nuts 17 are once again connected to the threaded partial tie-rod ends of a following panel-shaped element.

If the coupling part which is located between the two panel-shaped elements 12 in Fig. 4 were to be an end coupling part, this coupling part would be rotated through 180° about its longitudinal axis, so that the coupling nuts ensure that the coupling part 14 is pulled onto the panel-shaped element 12 and in this way the panel-shaped element 12 is clamped between the right-hand and left-hand coupling parts (in this case, the coupling parts are arranged mirror-symmetrically with respect to one another).

It should be noted that the tie rods which pass through the panel-shaped elements allow desired elements to be secured thereto.

At the location of the tie rods, panel-shaped elements may include openings into which a component fits; this component is to be described in more detail below, has the tie rod passing through it and can be used to attach, for example, a hinge part for a door. All kinds of other means for securing functional materials, such as rails, rods, hooks, runners, etc. may also indirectly connected and fixed to the tie rods.

Fig. 5 shows, on an enlarged scale, how a coupling part 14 is connected to a partial tie rod 15' with the aid of a coupling nut 17. The partial tie rod 15' has a threaded end 15a which is received in a threaded end of the coupling nut 17. With the aid of a hexagon socket section 19, the coupling nut can be turned with respect to the threaded end 15a of the partial tie rod 15'. It can be seen from Fig. 5a that the coupling nut 17 with hexagon socket section 19 fits into an opening 17' in the coupling part 14 which is formed to be complementary with respect to the nut. An opening 18' which is suitable for receiving a coupling nut which can couple vertically oriented partial tie rods is located at a short distance from the opening 17'. It can be seen from Fig. 5a that the coupling part 14 comprises an insert piece 14' in which the openings are accommodated; the insert piece 14' has been introduced into the end of the coupling part 14; the ends of the openings which are

present therein coincide with openings in the outer surfaces of the coupling part 14. The coupling part 14 may be formed from metal, such as aluminium, or plastic, such as nylon. The insert piece 14' is expediently formed from nylon or any other suitable dimensionally stable plastic.

The coupling nuts 17 (or coupling nuts 47 or spacer sleeve 57) may be made from metal (such as aluminium) or plastic (such as nylon).

Fig. 6 shows a sketch, in cross section, of a coupling part 24 which is designed to adjoin panel-shaped elements 22 and 23. The coupling part 24 comprises protuberances 24a which bear over a short distance against the surfaces of the panel-shaped elements 22 and 23 and which ensure that when the furniture system is in use the panel-shaped elements cannot sag. In this figure, all sides of the coupling part are interacting with a panel-shaped element; of course, a coupling part may also interact with fewer than four panel-shaped elements, i.e. with one, two or three panel-shaped elements. The coupling part may be made from metal or plastic and may be designed as indicated above in Fig. 5a.

Fig. 7 shows that a tie rod does not always have to run from one coupling part to the next via the interior of a panel-shaped element. This figure shows a panel-shaped element 2 with two coupling parts 34 adjoining it, the coupling parts projecting outside the panel-shaped element 32 and the tie rod running outside the panel-shaped element.

Fig. 8 shows a sketch which illustrates how a tie-rod 35 which runs outside a panel-shaped element may be positioned inside a cavity which is recessed into the end side of the panel-shaped element 32.

Fig. 9 shows a coupling nut 47 with a cylindrical external cross section and with a hole in which there is an internal screw thread 48. This coupling nut is used when a tie rod is assembled from partial tie rods, but the tension in the assembly of

partial tie rods is to be realized by tightening from the two ends of the tie rod assembled from these parts.

Fig. 10 shows a spacer sleeve 57 with a cylindrical hole 58 which is not threaded. A cylindrical spacer of this type is used to guide the tie rods formed in a single piece which are used through the respective coupling parts, in which case the tension in the entire tie rod is formed by tightening cap nuts on the outer side of the corresponding furniture system.

Fig. 11 shows a situation in which panel-shaped elements are connected to one another under tension without the use of coupling parts.

The figure shows two second panel-shaped elements 63 and five first panel-shaped elements 62. The panel-shaped elements 62 and 63 are connected to one another by tie rods 65 which pass through cavities inside the first panel-shaped elements 62, with the connection between the two panel-shaped elements 63 and the various first panel-shaped elements 62 being created by tie rods 65 which are threaded at their ends, with cap nuts fitting onto these threaded ends, ensuring the required tension in the contact between the panel-shaped elements 62 and the panel-shaped elements 63 when they are tightened. Obviously, there may be a plurality of second panel-shaped elements 63. The tie rods 65 are in this case correspondingly lengthened.

Fig. 12 shows an enlarged view of a panel-shaped element 2 with cavities 5 and cavities 6a, 6b and 7a, 7b for tie rods or partial tie rods to pass through. It can be seen that a cavity 6a, 6b, 7a, 7b has a smaller dimension in the direction of the bearing surface of the panel-shaped element 2, which is just sufficient to allow the diameter of a tie rod to pass through. In a direction perpendicular to the bearing surface of the panel-shaped element 2, there are in each case two walls 6c, 7c present in each cavity 6a, 6b, 7a, 7b, resulting in a cavity which accurately allows a tie rod to pass through. All this is indicated on a larger scale in Fig. 12a.

Figure 13 shows an arrangement in which cavities 76a and 76b are present in a panel-shaped element 70, with a tie rod 71 running inside cavity 76b. The tie rod 71 functions, for example, in the manner which has been explained in Figure 4. In addition to the cavities 76a and 76b, which are designed as described in Figures 12, 12a, additional ribs 75 are also present in the panel-shaped element. The panel-shaped element is an extruded panel-shaped element made, for example, from polypropylene. In the panel-shaped element there is an opening in which a securing sleeve 72 is accommodated. The securing sleeve 72 comprises an opening 73 which allows the tie rod 71 to pass through. The securing sleeve 72, which is in this case cylindrical, has internally threaded holes 74a and 74b at its ends. Desired components which are to be connected to the bearing surfaces of the panel-shaped element 70, such as handles and locks, hinges, rails, runners and the like, can be fixed to the securing sleeve 72 with the aid of suitable bolts.

Figure 14 shows a securing sleeve 72 which is cylindrical in shape and has an opening 73 for a threaded rod to pass through and internally threaded holes 74a and 74b. The securing sleeve may be made from metal, such as aluminium, but may also be made from plastic, such as nylon.